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ATMOSPHERIC 222RN MEASUREMENTS AT SAN NICOLAS ISLAND DURING 198--ETC(U)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The results of radon concentration measurements in the near surface air at San Nicolas Island, California, are presented for five different measurement sessions between May 1978 and July 1980. Emphasis is on the previously unreported results for January and July 1980. For six of eight days during the January session the measured radon concentration was greater than ~~40 pCi m^{-3}~~, corresponding to a continental air mass. Only the first day involved a maritime air mass with radon concentration less than about

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20. ABSTRACT (Continued)

$6\ _pCi\ m^{-3}$. In contrast to all the previous sessions, maritime air dominated the ten day session in July 1980, with radon concentrations generally less than about $5\ _pCi\ m^{-3}$.

6 picocuries per cm

5 picocuries per cm.

ATMOSPHERIC ^{222}Rn MEASUREMENTS AT SAN NICOLAS ISLAND DURING 1980

Background

Radon (^{222}Rn) measurements provide a simple, reliable, real-time indicator of the relative maritime or continental nature of the air over coastal or ocean areas. ^{222}Rn has a half life of 3.8 days and originates from the decay of ^{226}Ra, a member of the ^{238}U decay chain. At least 98% of ^{222}Rn originates from continental land masses (Wilkening and Clements, 1975), and radon concentrations measured a few meters above the surface of land areas are of the order of 100 $_p$Ci m^{-3} (picocuries per cubic meter). Atmospheric radon concentrations depend upon crustal radium deposits and the physical properties of the surface which affect diffusion of radon out of the ground, as well as atmospheric stability. A few $_p$Ci m^{-3} or less of radon are indicative of maritime air which has had a long trajectory over the North Atlantic and North Pacific (Larson et al, 1972: Bressan et al, 1974). Changes in radon concentration indicate changes in air mass. Radon as a tracer is discussed in more detail in Larson et al (1979), Maenhaut et al (1979) and Beck and Gogolak (1979). The 3.8 day half life of radon is very near the global average of 3 days for the lifetime of cloud nuclei over oceans when continental air masses drift out to sea, as determined by Twomey and Wojciechowski (1969). Radon is a rare gas and its concentration is reduced only by radioactive decay and diffusion, while some aerosol

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particles can settle out or be washed out in much less than 3 days. Thus radon serves well as an indicator of the presence and age of air masses recently in contact with a continent.

Aerosol sources for the air over San Nicolas Island during the CEWCOM-78 data period as indicated by radon measurements (Larson, Bressan and Kasemir, (1979) were usually in excellent agreement with the sources as determined by Rosenthal et al (1980) and Niziol et al (1980). The conclusions of Rosenthal et al were based on the surface and upper charts,GOES and DMSP satellite data, surface and radiosonde data, and weather station data. The air mass characterizations of Niziol et al (1980) were based on Aitken particle concentration and meteorological considerations. The apparent disagreements for May 19, 20 and 21 when trajectory analysis data (Rosenthal et al, 1980) indicated maritime influence while radon data (Larson and Bressan, 1980) indicated moderately continintal air, is resolved by the Aitken nuclei data (Niziol et al, 1980) which indicate aged continental air. Thus continental air had moved out over the Pacific Ocean and curved back to San Nicolas Island after having been over water long enough to appear to be maritime by its derived trajectory, but short enough for the radon content to remain fairly high.

The data reported here were collected as part of the Naval Research Laboratory's (NRL) San Nicolas Island meteorological experiments in the marine atmospheric surface layer under the auspices of the Elector-Optics Meteorology Program (EOMET) of the Naval Ocean Systems Center.

Most of the data reported here were collected 6 meters above the ground on the NRL tower 20 meters from the surf on the Northwest tip of San Nicolas Island. Some samples (as noted in the data) were taken at the Communications Center located at an altitude of 900 feet.

Results and Discussion

Radon data collected in January 1980 is shown in Figure 1. After a day and a half of maritime air, a transition to continental air began and continental air prevailed for the remaining six days. These data are similar to previous data (Larson et al, 1979 and Larson 1979) shown in Figures 3 and 4 in that a continental influence was present for the majority of the data collection days. However, most of the radon concentrations were over 40 $_{p}$Ci m^{-3} throughout the six days of continental influence during January, suggesting that the flow of air to San Nicolas Island may have been more directly from land than during previous deployments.

Maritime air prevailed throughout ten days in July 1980 as shown in Figure 2. On only three days did radon at the tower exceed 5 $_{p}$Ci m^{-3}, and only two samples had more than 10$_{p}$Ci m^{-3} radon and can be considered moderately continental. This is in contrast to past data collection periods when only one or two days at a time were in maritime air as determined by radon measurements. In Figure 2, open circle symbols indicates samples collected at an altitude of 900 feet at the top of San Nicolas Island. These concentrations tend to be greater than comparable concentrations at the tower and suggest some radon exhalation from the Island. It is to be noted that the air masses involved were often capped by an inversion lying at a level of about 0.5 to 2 km m.s.l. These relatively shallow air masses were separated by the inversion from the overlying or superior airmass of subsiding air associated with the resident high pressure system.

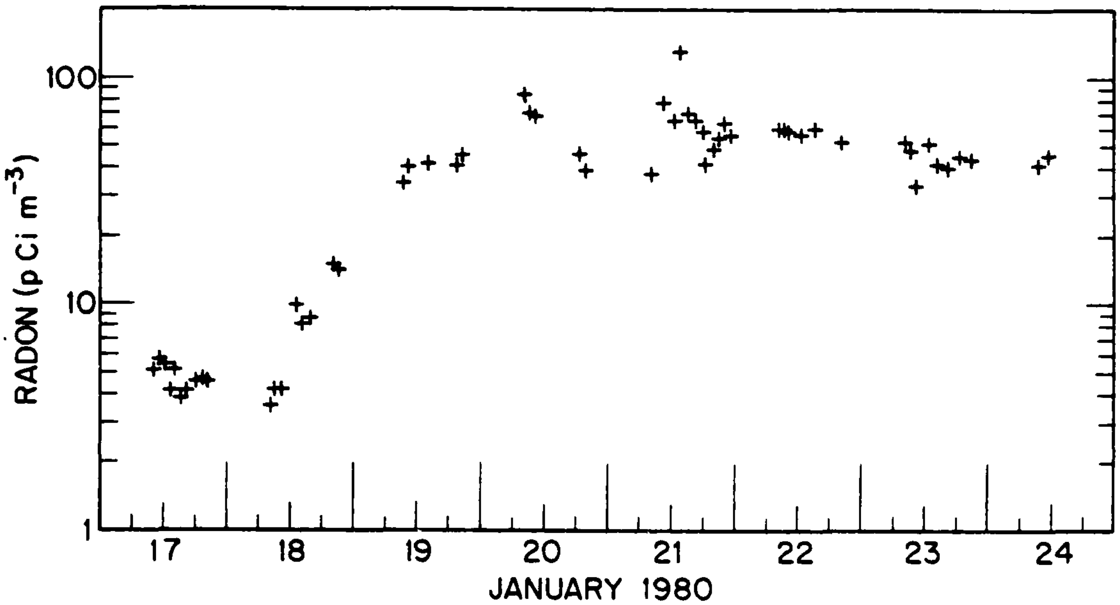

Figure 1- ^{222}Rn concentrations measured at a tower located on the Northwest tip of San Nicolas Island in January 1980. Samples were collected six meters above ground and the tower was 20 meters from the surf.

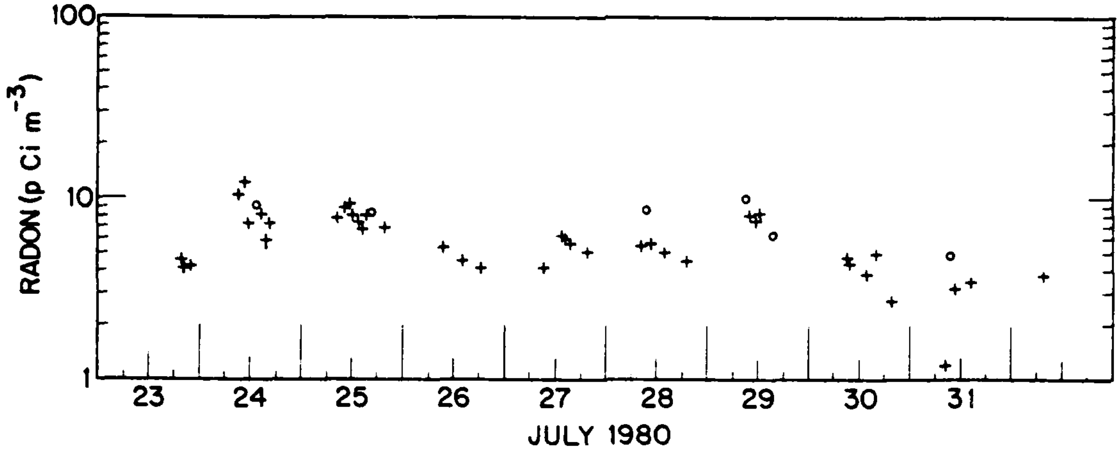

Figure 2 - ^{222}Rn concentrations measured at San Nicolas Island in July 1980. Crosses represent data collected at the tower. Circles represent samples collected at the top of the island at an altitude of 900 feet.

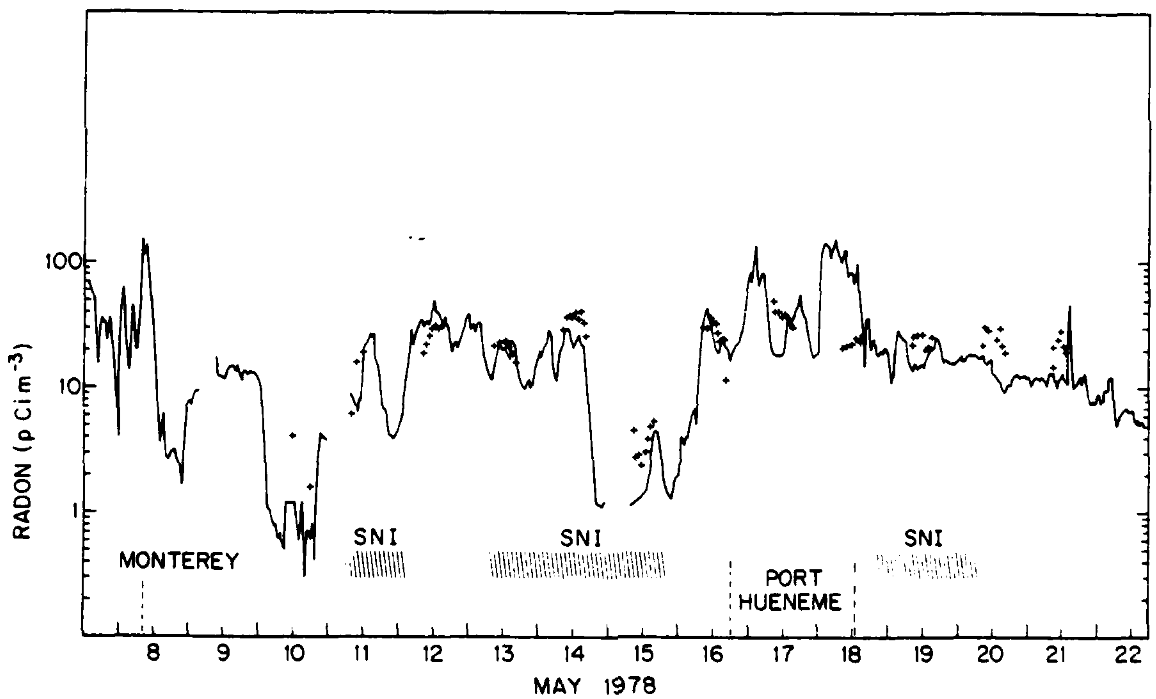

Figure 3 - ^{222}Rn during CEWCOM - 78. Crosses represent individual samples collected at San Nicolas Island. Close hatching indicates when the R/V Acania was close to the island and broad hatching indicates when ship was upwing of the island.

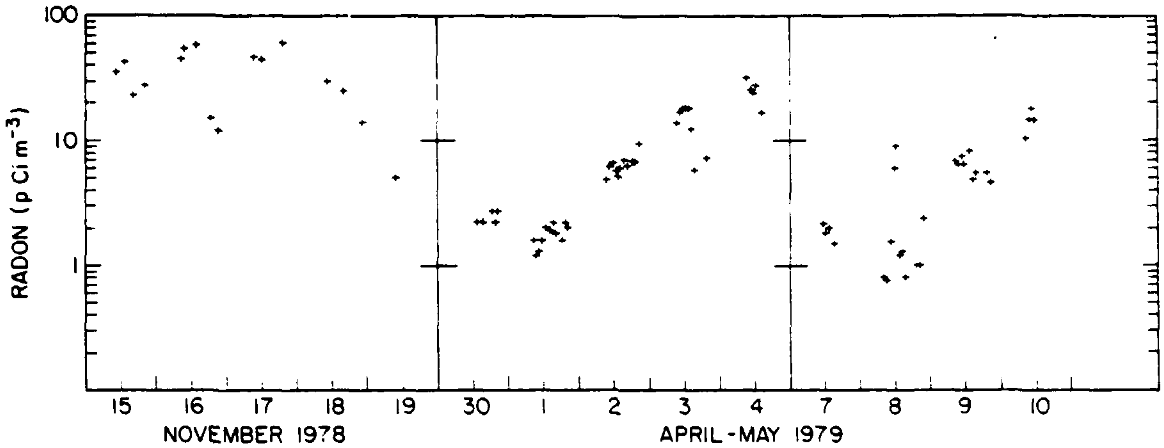

Figure 4 - ^{222}Rn concentrations measured at the tower in November 1978 and April-May 1979.

Conclusions

Data collected during 1980 show that periods of mostly maritime air occur at San Nicolas Island, as well as periods of mostly continental air. The data from the five separate measurement sessions suggest that continental air may be more likely during the winter and maritime air in the summer.

The importance of continual real-time monitoring is shown by the data of 19 January 1980 when maritime air was over the Island between 8 and 11 am, followed by mixed air between 1 and 4 pm, and moderately continental air after 8 pm.

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